The Cost-Effectiveness of Using Site-Specific Wastewater-Based Surveillance to Monitor COVID-19 in Long-Term Care Facilities

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Introduction

- Long-term care facilities (LTCFs) were disproportionately impacted during the pandemic.
- Routine universal testing is effective but resource intensive and burdensome
- Wastewater surveillance offers an alternative approach by sampling a facility's sewer system to measure collective viral load.

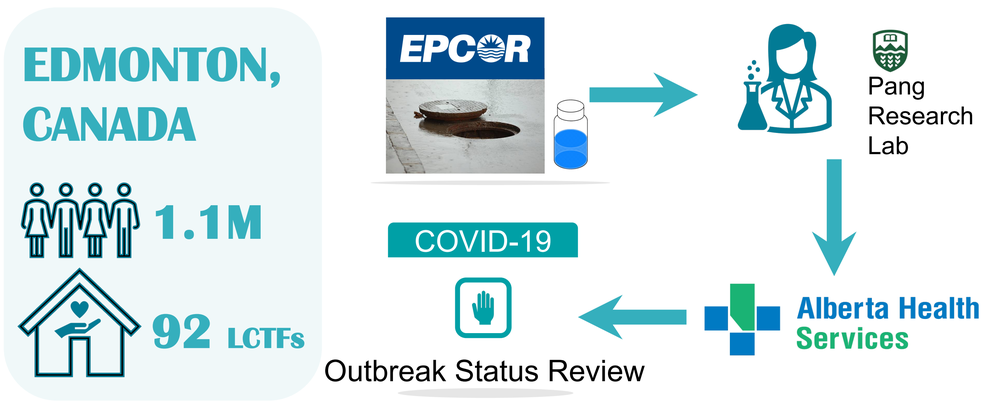
Question

Is Wastewater surveillance cost-effective for monitoring COVID-19 in LTCFs?

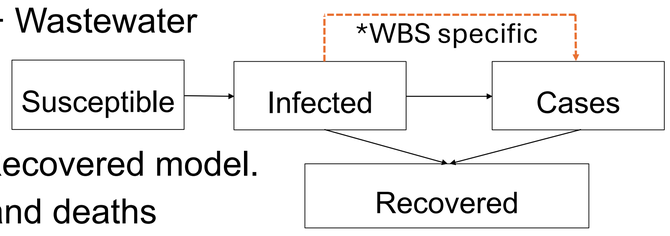
Our findings

Based on a real-world, site-specific WBS program, WBS is a cost-effective tool for mitigating COVID-19 impacts in LTCFs, particularly during the early stages of the pandemic.

- Public payer perspective
- Wastewater monitoring was conducted in 9 LTCFs in Edmonton, Canada between Jan 2021 and Feb 2023, with samples collected 2-3 times per week

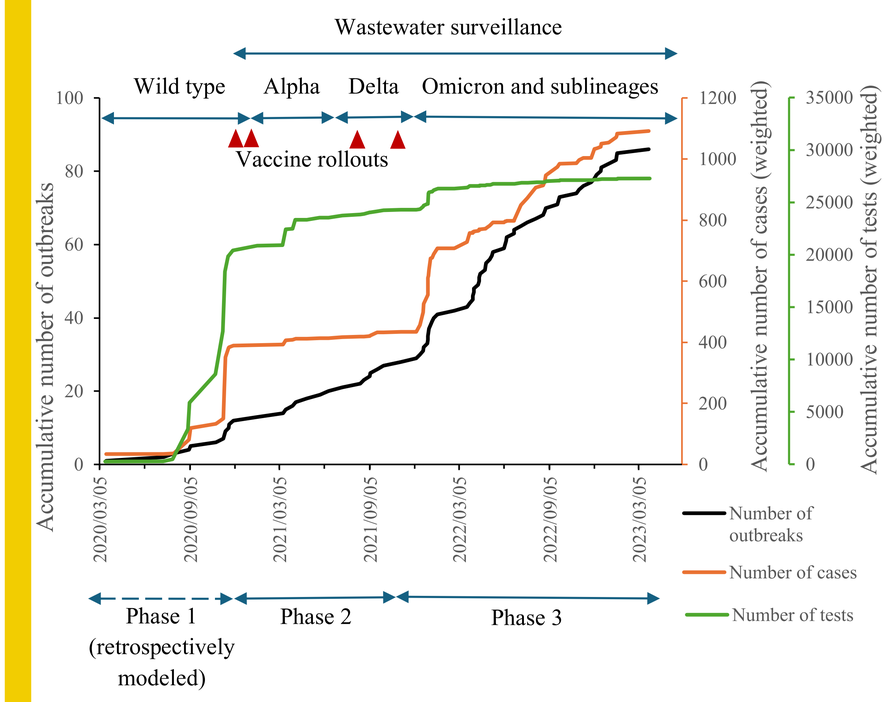


- Stakeholders were engaged to define WBS-based actions and confirm evaluation plan.
- Epidemiological and cost data were obtained from multiple provincial and federal administrative sources.
- Epidemiological + Wastewater data informed a Susceptible-Infected-Cases-Recovered model.



- Hospitalizations and deaths estimated in proportion to the number of cases.
- Utility decrements due to COVID-19 infection followed assumptions from previous literature[#].
- Probabilistic analyses estimated the incremental cost-effectiveness ratio (ICER) of WBS versus Standard Care.

Results



Epidemiological characteristics indicated three distinct phases for evaluation.

Phase 1: Early pandemic (2020 Mar – 2021 Feb)

Standard care: Mass testing
WBS: Trigger universal testing

Phase 2: During the pandemic (2021 Mar – 2021 Nov)

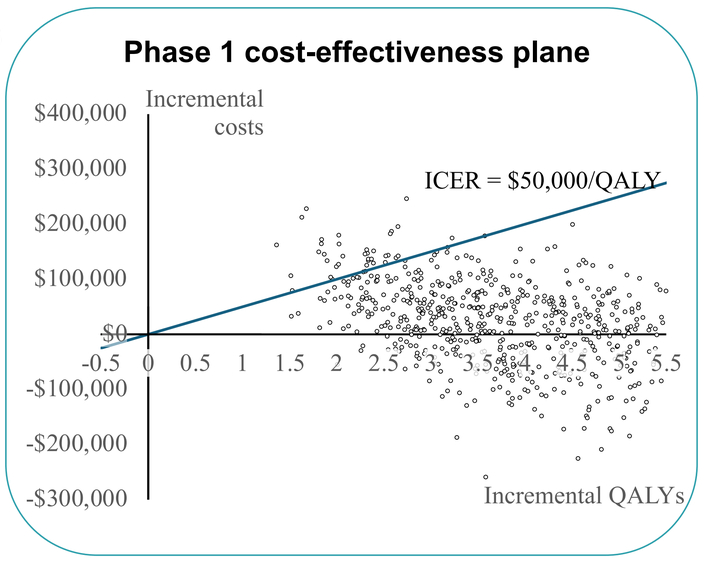
No outbreaks
WBS: reduce unnecessary testing (costs only, no effectiveness/QALYs)

Phase 3: Endemic (2021 Dec – 2023 Feb)

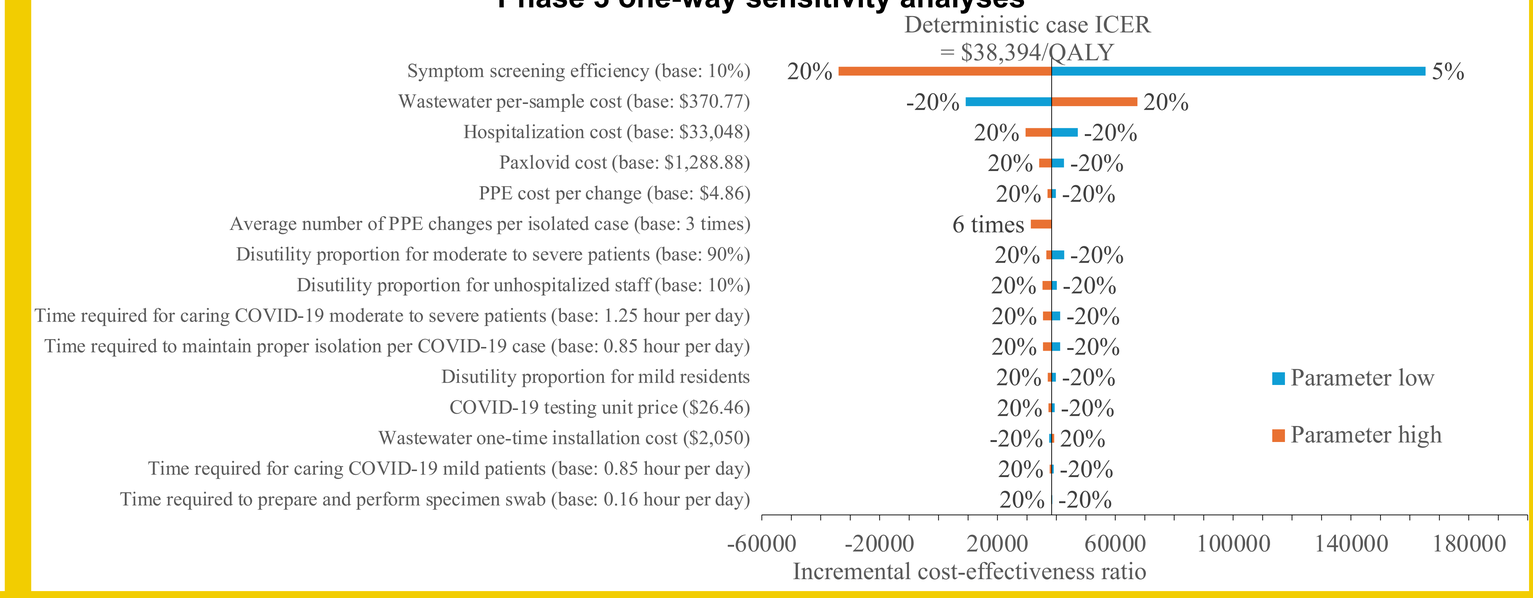
Standard care: Symptom-based testing
WBS: Trigger symptom screening

- WBS implementation: $1.62 million over 3 years
- WBS was most cost-effective during Phase 1.
- 96.3% being cost-effective ($50,000/QALY threshold); 39.6% being cost-saving
- When all three phases were considered together, WBS remained cost-effective.

	Incremental cost	QALY gained	ICER($/QALY)
Phase 1	13,941.28	6.75	2,064.73
Phase 2	356,874.00	0.00	-
Phase 3	172,804.37	4.67	37,019.45
Combined	543,394.13	11.6	47,263.26



- In Phase 1, WBS remained cost-effective at the $50,000/QALY threshold even when parameters varied by ±20%.
- In Phase 3, symptom-screening efficiency and per-sample wastewater costs were the most influential factors affecting ICER estimates.



Conclusions

- This is the first real-world economic evaluation of site-specific WBS.
- WBS was cost-effective in long-term care facilities, especially during the early pandemic when rapid detection and response were crucial.
- Results were sensitive to wastewater per-sample cost and to how well WBS-triggered actions found infections.
- The value of WBS was lower in periods with few outbreaks and effective vaccination.
- Adjusting sampling/testing in low-activity periods could improve overall efficiency.
- Future work:
  - Integrate WBS with individual-level and environmental data to enhance precision
  - Assess the use of WBS for other respiratory threats.

Policy implications

- Use WBS as an early-warning tool alongside clinical testing.
- Incorporate WBS into preparedness plans for future pandemics and institutional surveillance.
- Establish clear protocols for how WBS results could trigger testing or prevention actions in facilities for better uptake.

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Reference:
[#]. Mar J et al (2024). PharmacoEconomics. 2024;42:219–29

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